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ROYAL SIGNALS AND RADAR ESTABLISHMENT,  
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GUIDE TO CHARGING  
FOR THE CCF

Author: R F Bateman

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RSRE  
Malvern, Worcestershire.

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ROYAL SIGNALS AND RADAR ESTABLISHMENT

Report 89022

Title: Guide to charging for the CCF

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Date: December 1989

Summary

This report explains the method by which the RSRE Central Computing Facility (CCF) costs are fully recovered using the CCF charging mechanism. The costs to be recovered are Capital Assets, Support, Maintenance, Consumables and Non-distributed and these are recovered by charging for services. i.e. CPU used, storage allocated and direct support to tasks, divisions and RSRE.

More services will be added in <sup>the</sup> future which will reduce the existing service charges in proportion.

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# **GUIDE TO CHARGING**

## **FOR THE CCF**

### **1 Introduction**

Many changes have occurred in 1989/90 to the Central Computing Facility (CCF) and the way in which charges for its use are passed onto its customers. The CCF management is tasked with recovering the full costs of running the facility via a suitable charging mechanism so as to ensure a fair distribution of the costs. This paper attempts to justify the method by which the costs are converted to charges to individual tasks, etc.

#### **1.1 Costs**

The costs incurred by the CCF fall into five categories. These are:-

##### **Equipment Costs**

This represents the depreciation for all equipment on the Capital Assets Register over its life (typically 5 years, therefore 20% per annum) plus the interest charged on the original 'loan' at 6%.

##### **Support Costs**

This represents all the direct costs of employing manpower at RSRE, including contractors. It covers salary, ERNIC, etc.

##### **Maintenance Costs**

Covers the cost of hardware and software maintenance and includes, in the case of the CCF, the cost of FULL software support for the site (See later notes).

##### **Consumable Costs**

Covers the provision of stores and services to the CCF.

##### **Non-distributed Costs (NDC)**

This covers the infra-structure costs incurred by RSRE. i.e. buildings, electricity, gas, fire services, etc. and is allocated by Costs Office to divisions using a suitable algorithm. Broadly, the NDC are proportional to the amount of space consumed by individuals and equipment and accordingly have been split and added to the cost of equipment and the

cost of support in the ratios of the space consumed by equipment and staff (9 to 4) in order to simplify its disposition.

In addition, the way in which the basic costs are calculated is changing and has resulted in a fall from £1.7M down to an estimated £1.26M for 1989/90.

## 1.2 Charges

In April 1989 the method of charging for the CCF changed from the supply of raw CPU seconds and disk blocks to a service based system. At present there are five categories of service:-

- ☐ Supply of CPU seconds.
- ☐ Supply of Storage (Blocks).
- ☐ Supply of Direct Support to Tasks.
- ☐ Supply of Direct Support to Divisions.
- ☐ Supply of Direct Support to RSRE.

In April 1990 a further three services will be added and be separately charged for. These are:-

### Applications

A per CPU second charge for invocations of selected software (e.g. Ada, Algol, etc.) in addition to the basic CPU charge.

### PC Services

A fixed charge of £360 per annum for PC's connected to the CCF. This will allow down-line loading of standard software, access to Allin1 mail, access to the CCF filestore, etc.

### Secure CCF

(SCCF)

Further services will be added, and charged for, in the future. These new charges will reduce the previous charges so that the overall recovery remains essentially constant.

## 1.3 Concepts

The above changes are a result of the deliberations of the ITSC Working Party on Computer charging. Broadly, the concept is that customers should pay only for services received, both actual and potential. The amounts of CPU seconds and disk blocks allocated are recorded and the charges calculated directly. Direct support to tasks covers the support and any other resources consumed for specific tasks requested by a customer (with the charges estimated ahead of time). Direct support to divisions covers the software distribution and maintenance service provided by the CCF for divisional computers. Direct to RSRE covers those services that cannot sensibly be allocated to individuals or are provided as a matter of policy. They include

- Office Automation (policy)
- Availability of the CCF to RSRE
- Software maintenance (the CCF pays heavily for FULL maintenance to support the other VAX's on site)
- software and hardware evaluation.

## 1.4 Changes

As a result of the above changes the charges are now distributed more fairly between our customers and have resulted in a lowering of the basic CPU and storage rates. These are:-

|                             | UP TO<br>APRIL 89<br>pence | APRIL 89<br>TO<br>APRIL 90<br>pence | FROM<br>APRIL 90<br>(ESTIMATED)<br>pence |
|-----------------------------|----------------------------|-------------------------------------|--|
| CPU secs. prime interactive | 10.0                       | 8.0                                 | 3.7                                      |
| Storage (p/block/day)       | 0.005*                     | 0.019                               | 0.007 p                                  |

\* The original charge for disk did not take account of support, maintenance and consumables.

## 2 Rationale

### 2.1 Costs

The costs which the CCF has to recover in Financial Year 1989-90 fall into 5 categories:

- ☐ Capital
- ☐ Maintenance
- ☐ Consumables
- ☐ Support
- ☐ Non-distributed costs

Non-distributed costs are broadly related to the amount of space occupied by equipment and staff. For 1989/90, the Non-Distributed Costs total is to be merged into Capital and Support in the ratio 9:4.

## 2.2 Charges

The services which CCF provides can be divided into two broad categories. Firstly, there are those services which are not directly related to the usage of the CCF and, secondly, there are services which are related to usage of the CCF.

| USAGE CHARGES |         | NON-USAGE CHARGES |                        |                   |
|---------------|---------|-------------------|------------------------|-------------------|
| CPU           | STORAGE | DIRECT<br>TO TASK | DIRECT TO<br>DIVISIONS | DIRECT<br>TO RSRE |

The approach taken is to calculate the cost of each set of services and then make an appropriate charge to cover those costs.

Thus, the services provided direct to RSRE or direct to divisions are charged by a standing charge upon divisions (there being no route to charge RSRE as a whole). Services provided direct to task are charged on the basis of manpower and other resources consumed. The services of computing power (CPU) and storage provided to users are recovered through per-unit usage charges to the users.

## 3 Annual Recovery of Capital

Figure 1 shows the original book values of the CCF kit split into computers and storage devices (disk & tape). The Annual Recovery must include depreciation (@ 20% - 5 years) and interest (@ 5%) on the totals:

Annual Recovery is calculated using the following algorithm:

$$\text{ANNUAL RECOVERY} = \text{DEPRECIATION} + \text{INTEREST}$$

$$\text{ANNUAL RECOVERY} = (20\% * 1,798,592) + (5\% * 1,798,592)$$

$$\text{ANNUAL RECOVERY} = 359,718 + 89,930$$

$$\text{ANNUAL RECOVERY} = 449,648$$

**Note:** The ratio of capital for CPU to capital for disk & tape is 383866 to 65782 which is 0.8537 to 0.1463. This ratio is used in calculations later on.

|                                | ORIGINAL BOOK VALUE | COMPUTERS | DISK & TAPE | TOTALS    |
|--------------------------------|---------------------|-----------|-------------|-----------|
|                                | 27,471              | 27,471    |             | 27,471    |
|                                | 8,977               | 8,977     |             | 8,977     |
|                                | 8,977               | 8,977     |             | 8,977     |
|                                | 8,977               | 8,977     |             | 8,977     |
|                                | 8,977               | 8,977     |             | 8,977     |
|                                | 8,977               | 8,977     |             | 8,977     |
|                                | 14,054              | 14,054    |             | 14,054    |
|                                | 184,543             | 184,543   |             | 184,543   |
|                                | 184,543             | 184,543   |             | 184,543   |
|                                | 184,543             | 184,543   |             | 184,543   |
|                                | 184,543             | 184,543   |             | 184,543   |
|                                | 8,501               |           | 8,501       | 8,501     |
|                                | 8,501               |           | 8,501       | 8,501     |
|                                | 4,899               |           | 4,899       | 4,899     |
|                                | 4,899               |           | 4,899       | 4,899     |
|                                | 4,945               |           | 4,945       | 4,945     |
|                                | 4,945               |           | 4,945       | 4,945     |
|                                | 8,030               |           | 8,030       | 8,030     |
|                                | 8,030               |           | 8,030       | 8,030     |
|                                | 31,908              |           | 31,908      | 31,908    |
|                                | 26,106              | 26,106    |             | 26,106    |
|                                | 11,838              |           | 11,838      | 11,838    |
|                                | 11,838              |           | 11,838      | 11,838    |
|                                | 15,780              |           | 15,780      | 15,780    |
|                                | 15,719              |           | 15,719      | 15,719    |
|                                | 81,054              | 81,054    |             | 81,054    |
|                                | 35,011              | 35,011    |             | 35,011    |
|                                | 15,780              |           | 15,780      | 15,780    |
|                                | 3,757               |           | 3,757       | 3,757     |
|                                | 13,231              |           | 13,231      | 13,231    |
|                                | 6,894               |           | 6,894       | 6,894     |
|                                | 14,316              |           | 14,316      | 14,316    |
|                                | 34,525              |           | 34,525      | 34,525    |
|                                | 29,199              | 29,199    |             | 29,199    |
|                                | 390,851             | 390,851   |             | 390,851   |
|                                | 8,548               | 8,548     |             | 8,548     |
|                                | 8,548               | 8,548     |             | 8,548     |
|                                | 13,394              | 13,394    |             | 13,394    |
|                                | 14,541              |           | 14,541      | 14,541    |
|                                | 35,786              | 35,786    |             | 35,786    |
|                                | 15,384              |           | 15,384      | 15,384    |
|                                | 35,786              | 35,786    |             | 35,786    |
|                                | 4,867               |           | 4,867       | 4,867     |
|                                | 46,599              | 46,599    |             | 46,599    |
| TOTAL                          | 1,798,592           | 1,535,464 | 263,128     | 1,798,592 |
| DEPRECIATION<br>(20% of total) | 359,718             | 307,093   | 52,626      | 359,718   |
| INTEREST<br>(5% of total)      | 89,930              | 76,773    | 13,156      | 89,930    |
| ANNUAL RECOVERY                | 449,648             | 383,866   | 65,782      | 449,648   |

Figure 1 - Estimated Inventory for CCF



## 4 Estimated CCF Costs for Financial Year 1989-90

Non-distributed costs have been split between capital (EQUIPMENT\_SPACE) and support (SUPPORT\_SPACE) in the ratio 9:4. This ratio represents the approximate split of space occupied by CCF equipment (EQUIPMENT\_SPACE) and office space (SUPPORT\_SPACE).

|                                       | NON-DISTRIBUTED<br>COSTS | EQUIPMENT | SUPPORT | TOTAL     |
|---------------------------------------|--------------------------|-----------|---------|-----------|
| NON-DISTRIBUTED<br>COSTS (9:4)        | 352,098                  | 243,760   | 108,338 | 352,098   |
| DEPRECIATION &<br>INTEREST ON CAPITAL |                          | 449,648   |         | 449,648   |
| SUPPORT (MANPOWER)                    |                          |           | 325,190 | 325,190   |
| TOTAL                                 |                          | 693,408   | 433,528 | 1,126,936 |

Figure 2 - Basic Split of Non-Distributed Costs

Figure 2 shows the basic split of non-distributed costs (buildings, utilities etc) between manpower and capital equipment. (For depreciation & interest on capital, see Figure 1.)

$$\text{EQUIPMENT\_SPACE} + \text{SUPPORT\_SPACE} = \text{NON-DISTRIBUTED COSTS}$$

$$\text{EQUIPMENT\_SPACE} + \text{SUPPORT\_SPACE} = 352,098$$

$$\text{EQUIPMENT\_SPACE} : \text{SUPPORT\_SPACE} = 9:4$$

Therefore,

$$\text{EQUIPMENT\_SPACE} = 9/13 * 352,098$$

$$\text{EQUIPMENT\_SPACE} = 243,760$$

and

$$\text{SUPPORT\_SPACE} = 4/13 * 352,098$$

$$\text{SUPPORT\_SPACE} = 108,338$$

The derived numbers for capital (EQUIPMENT\_SPACE) and support (SUPPORT\_SPACE) are then added to Annual Recovery and Support (Manpower) respectively to obtain the modified Capital and Support for 1989/90:

$$\text{CAPITAL} = \text{EQUIPMENT\_SPACE} + \text{ANNUAL RECOVERY}$$

$$\text{CAPITAL} = 243,760 + 449,648$$

$$\text{CAPITAL} = 693,408$$

and

$$\text{SUPPORT} = \text{SUPPORT\_SPACE} + \text{SUPPORT\_MANPOWER}$$

$$\text{SUPPORT} = 108,338 + 325,190$$

$$\text{SUPPORT} = 433,528$$

These calculations result in the new starting cost figures shown below:

| ITEM                      | ESTIMATED<br>COSTS<br>(1988/89) | MODIFIED<br>COSTS<br>(1989/90) |
|---------------------------|---------------------------------|--------------------------------|
| ANNUAL RECOVERY (CAPITAL) | 449,648                         | <b>693,408</b>                 |
| MAINTENANCE               | 221,063                         | 221,063                        |
| CONSUMABLES               | 52,000                          | 52,000                         |
| SUPPORT                   | 325,190                         | <b>433,528</b>                 |
| NON-DISTRIBUTED COSTS     | 352,098                         |                                |
| TOTALS                    | 1,399,999                       | 1,399,999                      |

Figure 3 - Estimated CCF Costs for Financial Year 1989/90

## 5 Basic Splits for Capital, Support, Maintenance and Consumables

The next task is to determine the split of capital, support, maintenance and consumables between:

- ☐ CPU
- ☐ storage
- ☐ direct to tasks
- ☐ direct to divisions
- ☐ direct to RSRE

**Note:** The idea of recovering charges against licences for selected software has been temporarily dropped since much software is normally purchased via PATs 3 at no cost to RSRE.

## 5.1 Determine Basic Split for Capital

The Annual Recovery (Capital) of 693,408 is split between CPU, storage, direct to task, direct to divisions and direct to RSRE. The amount of capital dedicated to "direct to" services (20.4%) is split off first. The remainder (79.6%) is split between CPU and storage in the ratio derived in section 3 (i.e. 0.8537 to 0.1463).

### Direct to Task

Direct to Task covers the percentage of Capital spent on mag tape usage in support of tasks. This accounts for 25% of the total magnetic tape usage on CCF and the total value of the tape drives is 80,000:

$$\text{DIRECT TO TASK} = (\text{USER\_MAG\_TAPE\_USAGE} / \text{CAPITAL}) * 100$$

$$\text{DIRECT TO TASK} = (80,000 * 25/100) / 449,648 * 100$$

$$\text{DIRECT TO TASK} = 20,000 / 449,648 * 100$$

$$\text{DIRECT TO TASK} = 0.044 * 100$$

$$\text{DIRECT TO TASK} = 4.4\%$$

### Direct to Divisions

|                             |             |
|-----------------------------|-------------|
| Setup of project machines   | 0.5%        |
| Software Distribution       | 0.5%        |
| Direct Support to divisions | 1.0%        |
|                             | <b>2.0%</b> |

### Direct Support to RSRE

|                               |              |
|-------------------------------|--------------|
| Software evaluation and setup | 1.0%         |
| Hardware evaluation and setup | 1.0%         |
| Software maintenance          | 2.0%         |
| Office Automation             |              |
| (ALLIN1, Visitor, Tele )      | 5.0%         |
| Availability of CCF to RSRE   | 5.0%         |
|                               | <b>14.0%</b> |

**Note:** A charge of 5.0% for Office Automation represents the recorded use to date and may well change in future.

The percentages of CPU and storage use for the services to task, divisions and RSRE add up to 20.4%. The remainder of the capital (79.6%) is then split between CPU and storage in the ratio of their capital values.

**CPU**

The annual depreciation and interest on capital for CPU is calculated as follows:

$$\text{CPU} = 79.6\% * \text{COMPUTERS} / ( \text{COMPUTERS} + \text{DISK \& TAPE} )$$

$$\text{CPU} = 79.6\% * 383,866 / 449,648$$

$$\text{CPU} = 79.6\% * 0.8537$$

$$\text{CPU} = \mathbf{67.95\%}$$

(for COMPUTERS and DISK & TAPE see Figure 1).

**Storage**

The annual depreciation and interest on capital for STORAGE is calculated as follows:

$$\text{STORAGE} = 79.6\% * \text{DISK \& TAPE} / ( \text{COMPUTERS} + \text{DISK \& TAPE} )$$

$$\text{STORAGE} = 79.6\% * 65,782 / 449,648$$

$$\text{STORAGE} = 79.6\% * 0.1463$$

$$\text{STORAGE} = \mathbf{11.65\%}$$

(for COMPUTERS and DISK & TAPE see Figure 1).

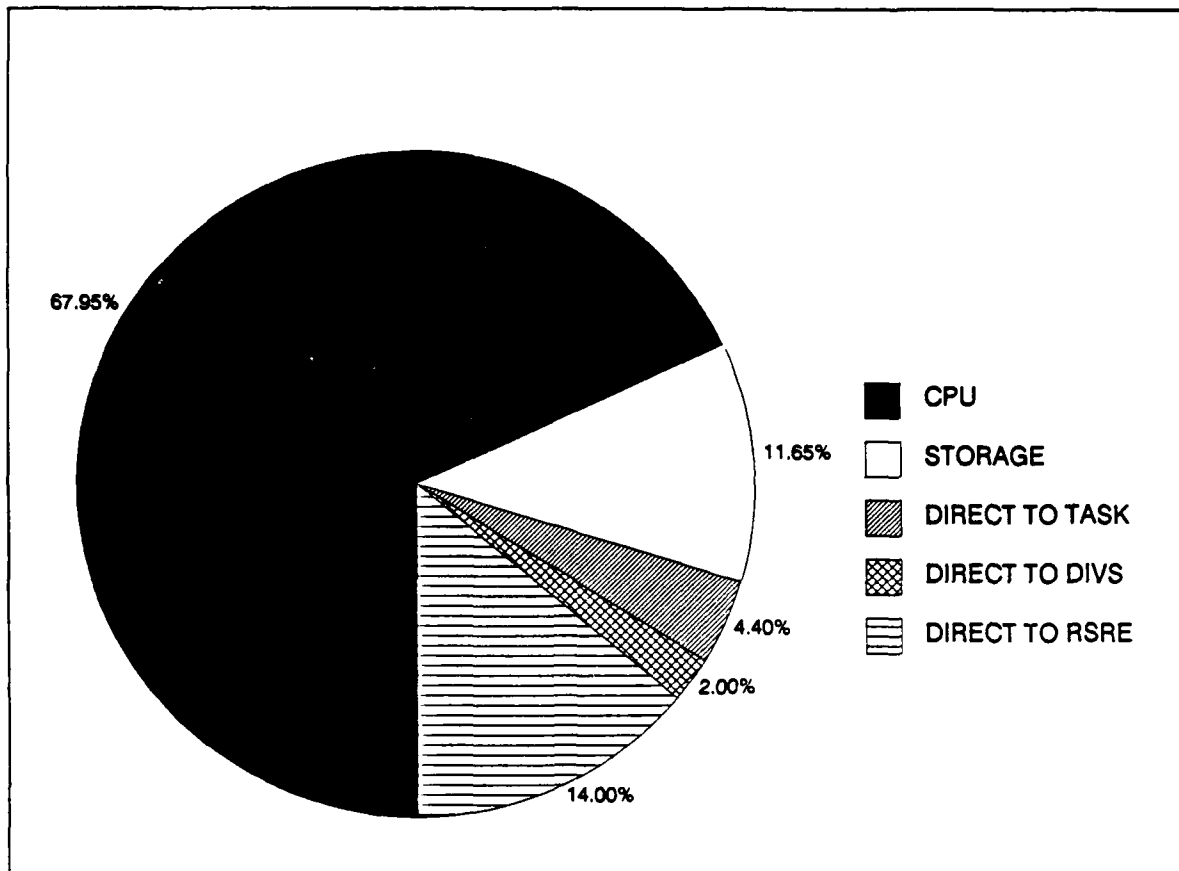


Figure 4 - Split for Capital

These calculated percentages are now applied to the new capital of 693,408 to obtain a breakdown:

| CAPITAL | CPU     | STORAGE | DIRECT<br>TO TASK | DIRECT<br>TO DIVS. | DIRECT<br>TO RSRE | TOTALS  |
|---------|---------|---------|-------------------|--------------------|-------------------|---------|
| 693,408 | 471,171 | 80,782  | 30,510            | 13,868             | 97,077            | 693,408 |

where:

$$\text{CPU} = 67.95\% * 693,408 = 471,171$$

$$\text{STORAGE} = 11.65\% * 693,408 = 80,782$$

$$\text{DIRECT TO TASK} = 4.4\% * 693,408 = 30,510$$

$$\text{DIRECT TO DIVISIONS} = 2.0\% * 693,408 = 13,868$$

$$\text{DIRECT TO RSRE} = 14.0\% * 693,408 = 97,077$$

## 5.2 Determine Basic Split for Support

CCF Support consists of five RSRE and six SERCO staff. The total cost of support is £433,528. Figure 9 shows the current split for all support effort (RSRE and SERCO) between tasks. These tasks are then split between CPU, storage and direct services to task, division and RSRE in the most appropriate way. The basic task split is reasonably accurate and is based upon logged times whenever possible. The split into services is an estimate since it is difficult to split certain items accurately because of inter-dependences, e.g. fault handling between CPU, storage and RSRE.

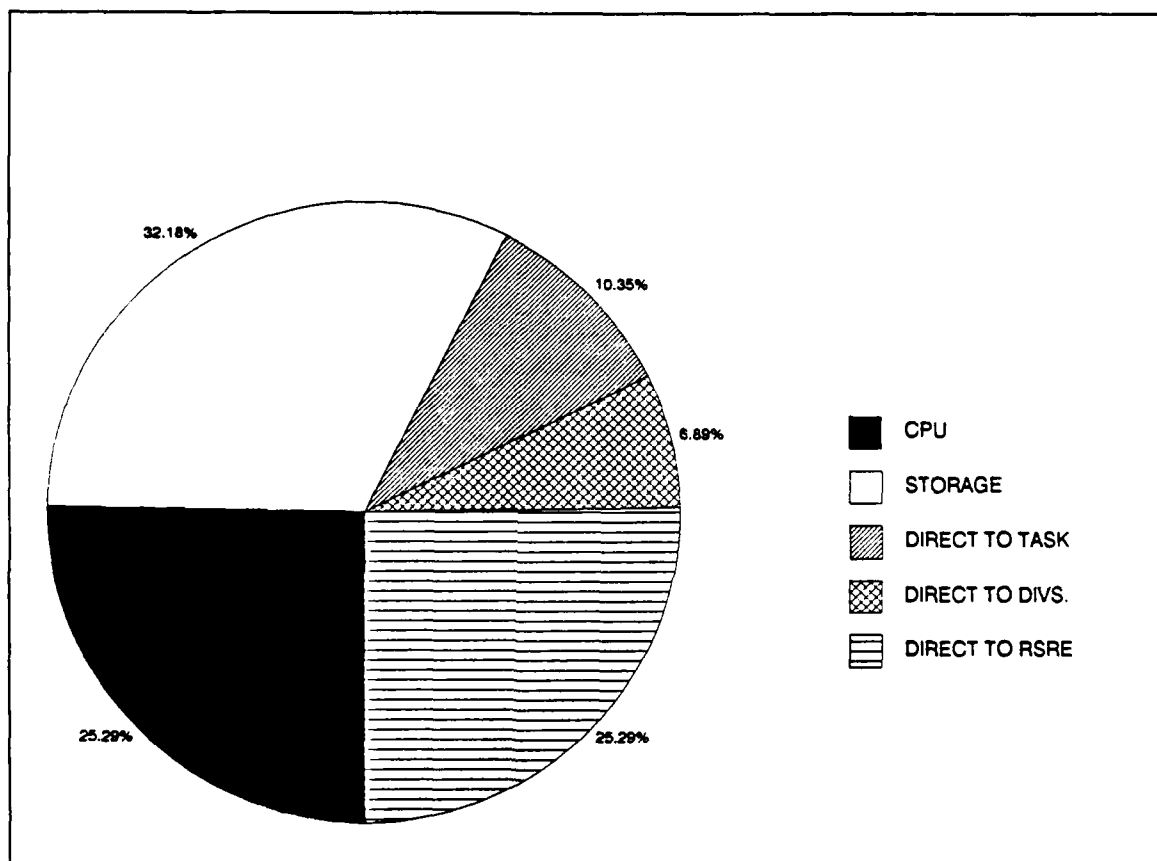


Figure 5 - Split for Support

Firstly, the manpower committed to a particular task is calculated as a proportion of the total manpower available (i.e. 11 full-time personnel). This proportion is then used to calculate the total amount spent on this task, e.g.

$$\text{FAULT HANDLING} = (\text{MANPOWER} / 11) * 433,528$$

$$\text{FAULT HANDLING} = (0.08 / 11) * 433,528$$

$$\text{FAULT HANDLING} = 3,153$$

This total amount is split between CPU, storage and direct services, e.g.

$$\text{FAULT HANDLING (CPU)} = 3,153 * 0.333$$

$$\text{FAULT HANDLING (CPU)} = 1,051$$

The amounts derived in this way are then totalled under each of the five headings (CPU, STORAGE, etc).

**Note:** Due to a spreadsheet error, the totals calculated here differ slightly from the figures used in figure 10. The correct figures will be used the next time the charging rates are recalculated. Since the overall effect on charging rates is small (and is an error in spread of costs, not total of costs), no retrospective adjustments will be made.

### 5.3 Determine Basic Split for Maintenance

Total cost of maintenance is 221,063, of which hardware costs 35,000 and software 186,063. Maintenance is calculated separately for hardware and software, since different criteria apply. The difference between software and hardware maintenance arises because the CCF is the only DEC machine on site with full software maintenance, all others being dependent on the CCF. The difference in cost, amounting to 13.8%, is shown as a direct charge to divisions.

Hardware maintenance is split in the percentages derived for the capital:

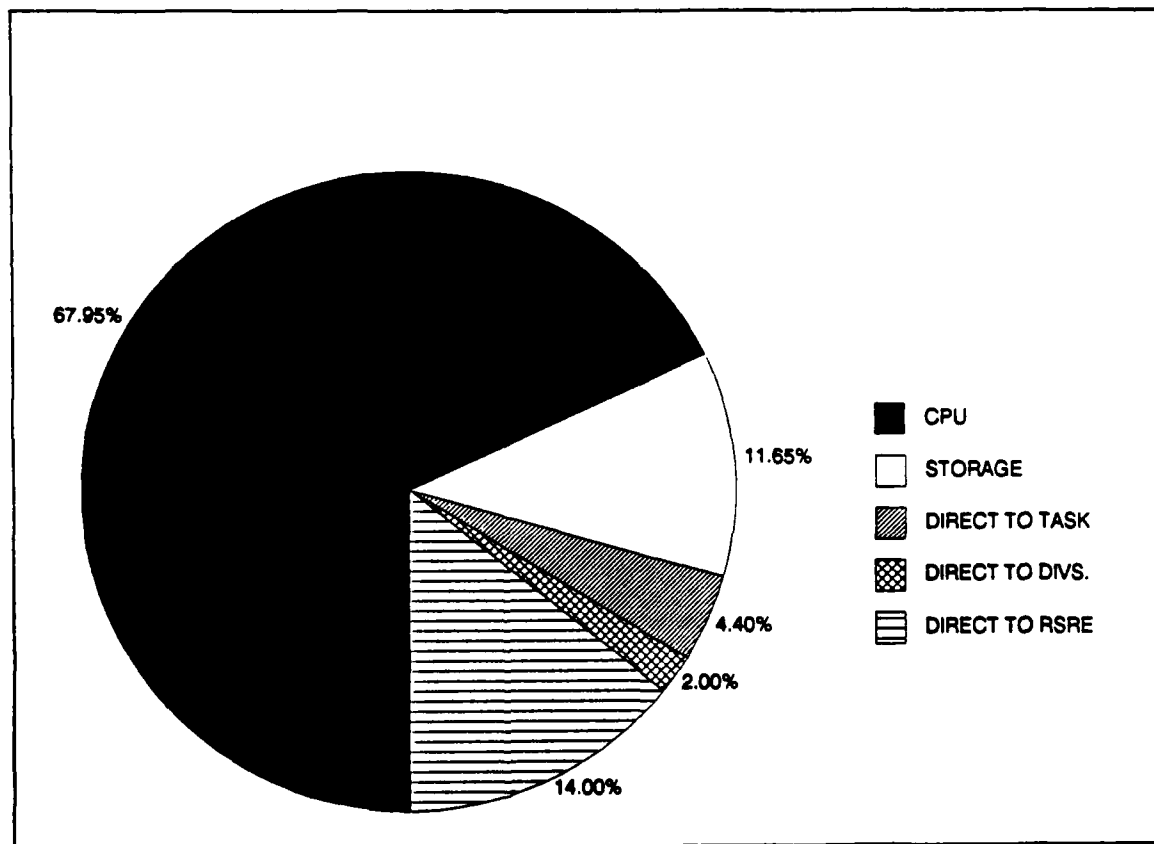


Figure 6 - Split for Hardware Maintenance

Software maintenance is derived by calculating the split for direct services (34.2%) and applying the ratio of capital costs (0.8537 to 0.1463, obtained at section 3) to the remainder for CPU and storage:

Direct to Task

DIRECT TO TASK = 4.4%

(see page 8)

Direct to Divisions

DEC software maintenance relies on one system acting as the FULL system. All other systems are dependent on the FULL system for support. The CCF pays an additional cost of 13.8% for this and does so on behalf of divisions.

|                                |              |
|--------------------------------|--------------|
| Setup of project machines      | 0.5%         |
| Software distribution          | 0.5%         |
| Direct support to divisions    | 1.0%         |
| FULL software maintenance cost | 13.8%        |
|                                | <b>15.8%</b> |

Direct to RSRE

|   |              |
|---|--------------|
| Software evaluation and setup                     | 1.0%         |
| Hardware evaluation and setup                     | 1.0%         |
| Software maintenance                              | 2.0%         |
| Office Automation :-<br>(ALLIN1, Visitor, Tele. ) | 5.0%         |
| Availability of CCF to RSRE                       | 5.0%         |
|   | <b>14.0%</b> |

CPU

The annual maintenance for CPU is calculated as follows:

$$\text{CPU} = (100 - (4.4 + 15.8 + 14.0)) * (\text{COMPUTERS} / (\text{COMPUTERS} + \text{DISK \& TAPE}))$$

$$\text{CPU} = 65.8 * 383,866 / 449,648$$

$$\text{CPU} = 65.8 * 0.8537$$

$$\text{CPU} = 56.17\%$$

(for COMPUTERS and DISK & TAPE see Figure 1).

Storage

The annual maintenance for storage (STORAGE) is calculated as follows:

$$\text{STORAGE} =$$

$$(100 - (4.4 + 2.0 + 14.0)) * (\text{DISK \& TAPE} / (\text{COMPUTERS} + \text{DISK \& TAPE}))$$

$$\text{STORAGE} = 79.6 * 65,782 / 449,648$$

$$\text{STORAGE} = 79.6 * 0.1463$$

$$\text{STORAGE} = 11.65\%$$

(for COMPUTERS and DISK & TAPE see Figure 1).



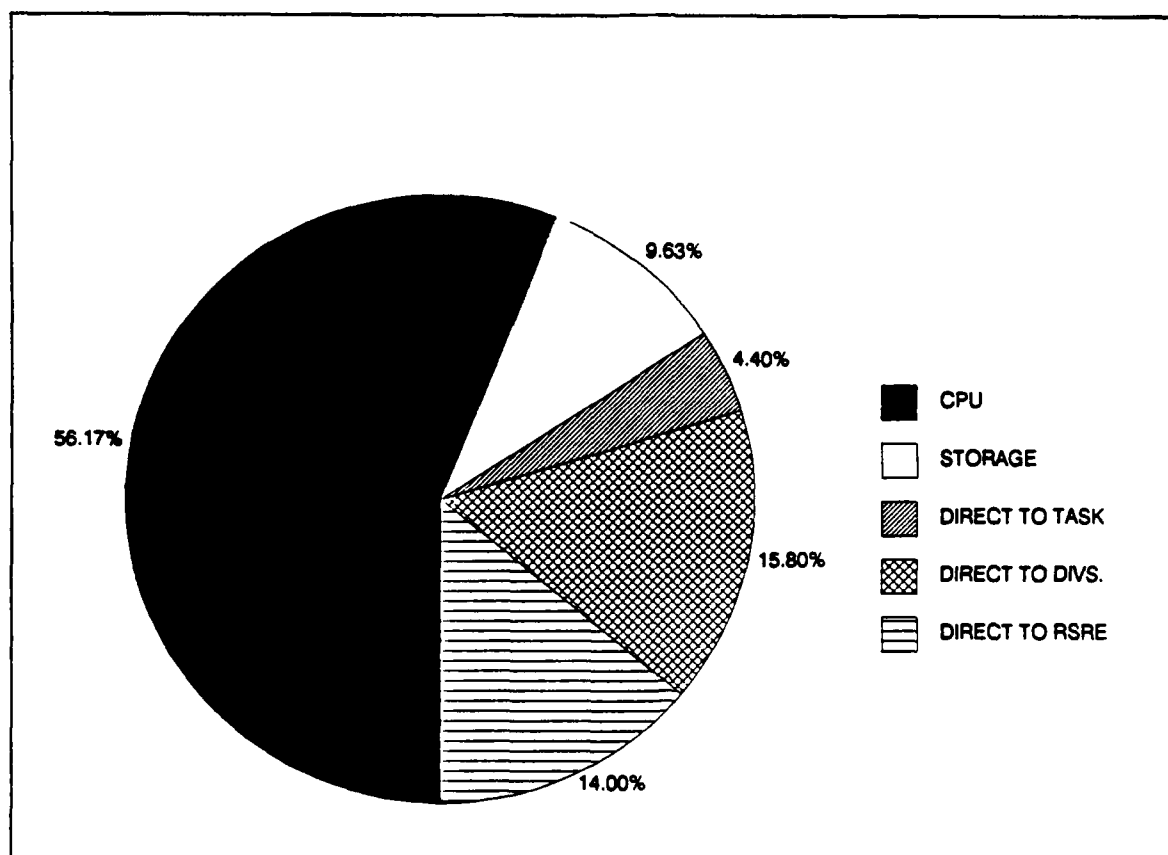


Figure 7 - Split for Software Maintenance

These percentages are now applied to the hardware and software maintenance totals in order to obtain a breakdown:

| MAINTEN-<br>ANCE ITEM | CPU     | STORAGE | DIRECT<br>TO TASK | DIRECT<br>TO DIVS | DIRECT<br>TO RSRE | TOTALS  |
|-----------------------|---------|---------|-------------------|-------------------|-------------------|---------|
| HARDWARE              | 23,783  | 4,077   | 1,540             | 700               | 4,900             | 35,000  |
| SOFTWARE              | 104,511 | 17,918  | 8,187             | 29,398            | 26,049            | 186,063 |
| TOTALS                | 128,294 | 21,995  | 9,727             | 30,098            | 30,949            | 221,063 |

where, for hardware:

$$\text{CPU} = 67.95\% * 35,000 = 23,783$$

$$\text{STORAGE} = 11.65\% * 35,000 = 4,077$$

$$\text{DIRECT TO TASK} = 4.4\% * 35,000 = 1,540$$

$$\text{DIRECT TO DIVISIONS} = 2.0\% * 35,000 = 700$$

$$\text{DIRECT TO RSRE} = 14.0\% * 35,000 = 4,900$$

and, for software:

$$\text{CPU} = 56.17\% * 186,063 = 104,511$$

$$\text{STORAGE} = 9.63\% * 186,063 = 17,918$$

$$\text{DIRECT TO TASK} = 4.4\% * 186,063 = 8,187$$

$$\text{DIRECT TO DIVISIONS} = 15.80\% * 186,063 = 29,398$$

$$\text{DIRECT TO RSRE} = 14.0\% * 186,063 = 26,049$$

## 5.4 Determine Basic Split for Consumables

The direct charges for consumables (i.e. direct to task, division and RSRE) are split in the ratio derived for capital costs. The remainder (79.6%) is split between CPU and storage in the ratio of stores and services spent for the categories (78.3% to 21.7%). These two ratios (0.783 and 0.217) are derived from a list of consumables which, because of its length, is not included in this document.

| USAGE CHARGES<br>79.6% |                  | NON-USAGE CHARGES<br>20.4% |                        |                   |
|------------------------|------------------|----------------------------|------------------------|-------------------|
| CPU<br>78.3%           | STORAGE<br>21.7% | DIRECT<br>TO TASK          | DIRECT TO<br>DIVISIONS | DIRECT<br>TO RSRE |

Therefore,

$$\text{CPU} = 79.6\% * 0.783$$

$$\text{CPU} = 62.3\%$$

and

$$\text{STORAGE} = 79.6\% * 0.217$$

$$\text{STORAGE} = 17.27\%$$

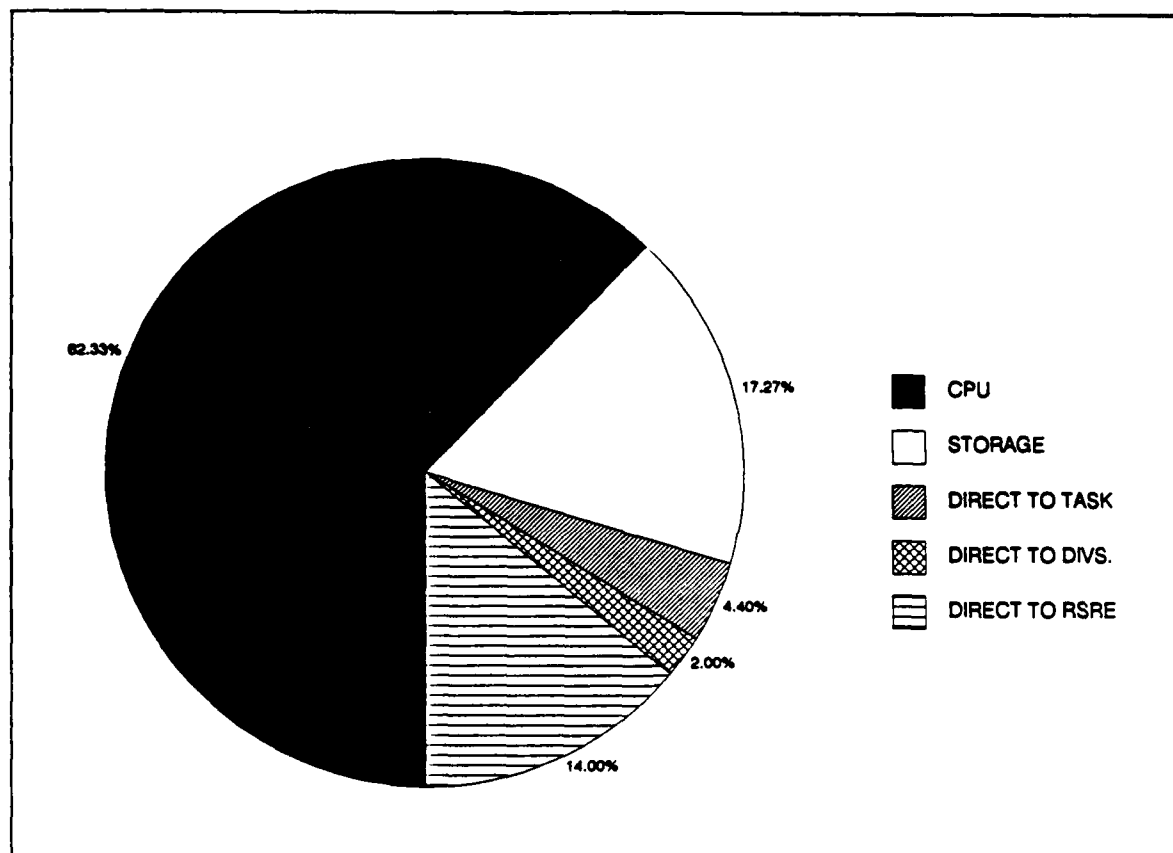


Figure 8 - Split for Consumables

These percentages are now applied to the consumables total in order to obtain a breakdown:

| CONSUM-<br>ABLES | CPU    | STORAGE | DIRECT<br>TO TASK | DIRECT<br>TO DIVS. | DIRECT<br>TO RSRE | TOTALS |
|------------------|--------|---------|-------------------|--------------------|-------------------|--------|
| 52,000           | 32,412 | 8,980   | 2,288             | 1,040              | 7,280             | 52,000 |

where:

$$\text{CPU} = 62.33\% * 52,000 = 32,412$$

$$\text{STORAGE} = 17.27\% * 52,000 = 8,980$$

$$\text{DIRECT TO TASK} = 4.4\% * 52,000 = 2,288$$

$$\text{DIRECT TO DIVISIONS} = 2.0\% * 52,000 = 1,040$$

$$\text{DIRECT TO RSRE} = 14.0\% * 52,000 = 7,280$$

## 6 Determine Basic CCF Charges for CPU and Storage

Finally, the charges for storage and CPU of 0.573 pence per block per month and 7.943 pence per CPU second for prime time interactive use are derived.

First of all, the totals to be recovered from CPU and storage (calculated at Figure 10) are added together. This results in a total recovery figure of 86,276 per month.

|                                    | PER ANNUM | PER MONTH |
|------------------------------------|-----------|-----------|
| Total to be recovered from CPU     | 777,808   | 64,817    |
| Total to be recovered from storage | 257,504   | 21,459    |
| TOTALS                             | 1,035,312 | 86,276    |

### 6.1 Storage

The following data was extracted from the QUANTUM records for 2 months (June and July 1989), since these are the most representative of current use:

| DISK USAGE                        | Disk Blocks<br>in Sample | Disk Blocks<br>per Month | Disk Blocks<br>Archived |
|-----------------------------------|--------------------------|--------------------------|-------------------------|
| Total (1)                         | 13,414,195               | 6,707,098                | 398,000                 |
| Non chargeable (2)                | 6,139,738                | 3,069,869                | 183,000                 |
| Disk Blocks recovered (1 minus 2) | 7,274,457                | 3,637,229                | 215,000                 |

From the two tables above, the basic cost per disk block per month is calculated as follows:

$COST\_MONTH =$

$(TOTAL\_STORAGE * 100) / (BLOCKS + ARCHIVE\_BLOCKS * ARCHIVE\_COST\_RATIO)$

$COST\_MONTH = (21,459 * 100) / (3,637,229 + 215,000 * 0.5)$

$COST\_MONTH = 2,145,900 / 3,744,729$

$COST\_MONTH = 0.573 \text{ pence per month}$

The basic cost per disk block per day is then derived:

$COST\_DAY = COST\_MONTH * 12 / 365$

$COST\_DAY = 0.019 \text{ pence per day}$

where:

$COST\_MONTH$  is calculated as the basic cost per disk block per month

TOTAL\_STORAGE is the total storage to be recovered per month

BLOCKS is the number of chargeable disk blocks per month

ARCHIVE\_BLOCKS is the number of chargeable archive disk blocks per month

ARCHIVE\_COST\_RATIO is the ratio of cost of archiving to cost of disk

Therefore:

TOTAL\_STORAGE = DISK BLOCKS RECOVERED PER MONTH + ARCHIVE DISK BLOCKS RECOVERED PER MONTH

TOTAL\_STORAGE = (3,637,229 \* 0.573%) + (215,000 \* 0.573% \* 0.5)

TOTAL\_STORAGE = 20,841 + 616

TOTAL\_STORAGE = 21,457<sup>1</sup>

## 6.2 CPU

The recoverable CPU seconds in the two month sample are given in Figure 11. These values are halved to give the recoverable CPU seconds per month.

The ratios of interactive to batch charges (taken from the old charges) are then normalised to overnight batch by dividing each ratio by 0.275 in order to make overnight batch 1.000.

A unit charge for overnight batch is calculated as follows:

UNIT\_CHARGE =

( TOTAL\_CPU \* 100 ) / ( ( CPU\_SECS \* NORM\_RATIO (Interactive Prime) ) +

( CPU\_SECS \* NORM\_RATIO (Interactive Off\_Prime) ) +

( CPU\_SECS \* NORM\_RATIO (Fast Batch) ) +

( CPU\_SECS \* NORM\_RATIO (Short Batch) ) +

( CPU\_SECS \* NORM\_RATIO (Normal Batch) ) +

( CPU\_SECS \* NORM\_RATIO (Over-night Batch) ) )

UNIT\_CHARGE = 6,481,700 / ( (504,946 \* 36.364) + (88,851 \* 18.182) + (508 \* 27.273) + (3,900 \* 18.182) + (1,043,893 \* 9.091) + (125,927 \* 1.000) )

UNIT\_CHARGE = 6,481,700 / (18,361,856 + 1,615,489 + 13,855 + 70,910 + 9,490,031 + 125,927)

UNIT\_CHARGE = 6,841,700 / 29,678,068

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Slight inaccuracy is due to rounding errors.

$$\text{UNIT\_CHARGE} = 0.218$$

where:

UNIT\_CHARGE is the calculated unit charge for overnight batch

TOTAL\_CPU is the total to be recovered from CPU

CPU\_SECS is the recoverable CPU seconds per month

NORM\_RATIO is the normalised ratio

From this calculated basic charge unit, the charge unit for the other types of CPU use are calculated as  $\text{NORM\_RATIO} * 0.218^1$ .

Clearly, the actual charge rates will vary in the future as the proportion of resources used for different functions changes, as will the "sales figures" in the calculations on page 17. Since the same basic algorithms are to be applied in the future, this document will not be reissued simply because the figures have changed.

R F Bateman

Head of Computing Services

18 October 1989

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<sup>1</sup>

Slight inaccuracies may result due to rounding errors.

| SUPPORT   | MANPOWER | CPU     | STORAGE | DIRECT TO TASK | DIRECT TO DIVS. | DIRECT TO RSRE | TOTAL   |
|---|----------|---------|---------|----------------|-----------------|----------------|---------|
| OPERATORS (3)   | 0.08     | 0.333   | 0.333   |                |                 | 0.333          | 3,153   |
| FAULT HANDLING  |          |         |         |                |                 |                |         |
| MEDIA HANDLING:   |          |         |         |                |                 |                |         |
| USER MAG. TAPE  | 0.25     |         | 1,000   | 1,000          |                 |                | 09,853  |
| BACKUP  | 0.86     |         | 1,000   |                |                 |                | 33,894  |
| ARCHIVE   | 0.15     |         | 1,000   |                |                 |                | 5,912   |
| MAG. DISK   | 0.12     |         | 1,000   |                |                 |                | 4,729   |
| STATE CHANGE  | 0.05     | 1,000   |         |                |                 |                | 1,971   |
| ENVIRONMENT   | 0.01     | 0.500   | 0.500   |                |                 |                | 394     |
| SOFTWARE INSTALLATION                                       | 0.25     | 1,000   |         |                |                 |                | 9,853   |
| DIRECT SUPPORT:-  |          |         |         |                |                 |                |         |
| SETUP PROJ. M/Cs  | 0.21     |         |         | 1,000          |                 |                | 8,276   |
| OTHER DIRECT SUPPORT  | 0.30     |         |         | 1,000          |                 |                | 11,823  |
| SOFTWARE DIST.  | 0.22     |         |         |                | 1,000           |                | 8,671   |
| OPS. DEVELOPT   | 0.30     | 0.500   | 0.500   |                |                 |                | 11,823  |
| OTHER ...   | 0.20     | 0.500   | 0.500   |                |                 |                | 7,882   |
| SYSTEM MANAGEMENT (5.12)                                    |          |         |         |                |                 |                |         |
| PLANNING (1.8)  | 0.20     | 0.333   | 0.333   |                |                 | 0.333          | 7,882   |
| SW EVAL, SETUP & LIAISON                                    | 0.15     | 0.333   | 0.333   |                |                 | 0.333          | 5,912   |
| HW EVAL, SETUP & LIAISON                                    | 0.50     | 0.500   | 0.500   |                |                 |                | 19,706  |
| SOFTWARE SETUP  | 0.95     | 0.333   | 0.333   |                |                 | 0.333          | 37,441  |
| DETAILED PLANNING   | 0.50     | 0.500   | 0.500   |                |                 |                | 19,706  |
| FAMILIARISATION & TRAINING                                  | 0.80     | 0.500   | 0.500   |                |                 |                | 31,529  |
| SOFTWARE MAINTENANCE  | 0.50     |         |         | 1,000          |                 |                | 19,706  |
| SUPPORT TO TASK   | 0.07     |         |         |                |                 | 1,000          | 2,759   |
| INTERNAL MEETINGS   | 0.70     |         |         |                |                 | 1,000          | 27,588  |
| DOCUMENTATION   | 0.55     | 0.500   | 0.500   |                |                 |                | 21,676  |
| SYSTEM DEVELOPMENT  |          |         |         |                |                 |                |         |
| DIRECT SUPPORT (2.88)                                       | 0.80     |         |         |                | 1,000           |                | 31,529  |
| DIRECT SUPPORT TO DIVISIONS                                 | 0.40     | 0.500   | 0.500   |                |                 |                | 15,765  |
| STAFF MANAGEMENT  | 1.50     |         |         |                |                 | 1,000          | 59,117  |
| HELP DESK   | 0.03     |         |         |                |                 | 1,000          | 1,182   |
| ITSC REPRESENTATION   | 0.05     |         |         |                |                 | 1,000          | 1,971   |
| REPRESENTATION ON OUTSIDE BODIES                            | 0.30     |         |         |                |                 | 1,000          | 11,823  |
| OFFICE AUTOMATION   |          |         |         |                |                 |                |         |
| Total of support  | 11.00    |         |         |                |                 |                |         |
| Cost of Support   |          | 94,1941 | 36,758  | 39,806         | 40200           | 122,570        | 433,528 |
| Cost carried forward to Figure 10 (see Note in section 5.2) |          | 109,627 | 139,526 | 44,849         | 29,899          | 109,627        | 433,528 |

Figure 9 - Current Split for All Support Effort

| CCF CHARGING<br>SERVICE | RECOVERABLES |                  |                  | HOW RECOVERED |                |                                 | TOTALS        | % SPLIT            |
|-------------------------|--------------|------------------|------------------|---------------|----------------|---------------------------------|---------------|--------------------|
|                         | CAPITAL      | MAINTEN-<br>ANCE | CONSUM-<br>ABLES | SUPPORT       | CPU<br>SECONDS | TAPES OR<br>BLOCKS<br>ALLOCATED | MAN-<br>HOURS | STANDING<br>CHARGE |
| RECOVERY :-             | 693,408      | 221,063          | 52,000           | 433,528       |                |                                 |               |                    |
| USING CPU               | 471,171      | 128,294          | 32,412           | 109,627       | 741,504        |                                 |               |                    |
| PERMANENT STORAGE       | 80,782       | 21,995           | 8,980            | 139,526       |                | 251,283                         |               | 53.0%              |
| DIRECT SERVICE TO TASK  | 30,510       | 9,727            | 2,288            | 44,849        | 36,304         | 6,221                           | 44,849        | 17.9%              |
| DIRECT SERVICE TO DIVS  | 13,868       | 30,098           | 1,040            | 29,899        |                |                                 |               | 6.2%               |
| DIRECT SERVICE TO RSRE  | 97,077       | 30,949           | 7,280            | 109,627       |                |                                 |               | 5.3%               |
| TOTALS                  | 693,408      | 221,063          | 52,000           | 433,528       | 777,808        | 257,504                         | 44,849        | 100.0%             |
| SPLIT                   |              |                  |                  |               | 55.6%          | 18.4%                           | 3.2%          | 22.8%              |

Figure 10 - CCF Charging Matrix



| CPU USAGE   | Interactive<br>Prime | Interactive<br>Off-peak | Fast<br>Batch | Short<br>Batch | Normal<br>Batch | Overnight<br>Batch | Total     |
|---|----------------------|-------------------------|---------------|----------------|-----------------|--------------------|-----------|
|   |                      |                         |               |                |                 |                    |           |
| Recoverable CPU secs in sample                    | 1,009,891            | 177,701                 | 1,015         | 7,800          | 2,087,786       | 251,8543           | 536,047   |
| Recoverable CPU seconds per month                 | 504,946              | 88,851                  | 508           | 3,900          | 1,043,893       | 125,927            | 1,768,024 |
| Ratio of int've to batch charges (old charges)(%) | 10.000               | 5.000                   | 7.500         | 5.000          | 2.500           | 0.275              |           |
| Ratios normalised to Over-night Batch             | 36.364               | 18.182                  | 27.273        | 18.182         | 9.091           | 1.000              |           |
| Unit charge (Overnight Batch). Pence/CPU sec.     |                      |                         |               |                |                 | 0.218              |           |
| Basic charges - pence/CPU sec                     | 7.943                | 3.971                   | 5.957         | 3.971          | 1.986           | 0.218              |           |
| CPU Recovery/month (£)                            | 40,105               | 3,528                   | 30            | 155            | 20,728          | 275                | 64,817    |

Figure 11 - Charges for CPU

# DOCUMENT CONTROL SHEET

Overall security classification of sheet .....UNCLASSIFIED.....

(As far as possible this sheet should contain only unclassified information. If it is necessary to enter classified information, the box concerned must be marked to indicate the classification, eg (R), (C) or (S))

|   |  |                        |   |                    |
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| <p><b>Abstract</b></p> <p>This report explains the method by which the RSRE Central Computing Facility (CCF) costs are fully recovered using the CCF charging mechanism. The costs to be recovered are Capital Assets, Support, Maintenance, Consumables and Non-distributed and these are recovered by charging for services, ie CPU used, storage allocated and direct support to tasks, divisions and RSRE.</p> <p>More services will be added in future which will reduce the existing service charges in proportion.</p> |  |                        |   |                    |